GSMA Intelligence

The impact of spectrum pricing in Bangladesh

GSMA

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www.gsmaintelligence.com

info@gsmaintelligence.com

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Executive summary

Mobile network infrastructure improvements are crucial to achieving Bangladesh's development goals

Bangladesh's path to a trillion-dollar digital economy depends on affordable, high-quality mobile connectivity. Reforming spectrum pricing is essential to unlock the full economic and social potential of mobile networks. Over the past decade, Bangladesh has expanded 4G coverage to 99% of the population, yet mobile internet usage remains low compared to peer countries – only 46% of the population use mobile internet, with an average monthly data consumption of just 5 GB per connection. This is in part due to limited device readiness, with 40% of users still relying on basic and feature phones. This will rapidly change as 4G and 5G readiness improves, and networks need to be prepared for the ever-increasing demand for mobile data.

Affordability in Bangladesh is a strength, with mobile subscription and data costs as a share of average income being lower compared to that of other countries, fostered by competitive market conditions. However, low operator revenues combined with high spectrum and regulatory costs create a challenging investment environment. Reducing these costs will enable greater investment, allowing Bangladesh to achieve the wider economic and developmental benefits of enhanced connectivity more quickly.

Networks in Bangladesh operate with less spectrum, but spectrum cost as a share of revenue is twice the global average

Spectrum is critical to efficiently scale up mobile networks. Bangladesh's operators currently utilise just over 500 MHz of spectrum, which is lower than what operators utilise in most other countries in Asia Pacific, despite recent allocations in the 2.3 and 2.6 GHz bands. In the most immediate term, successful renewals of licences in the 900 MHz, 1.8 GHz and 2.1 GHz bands, alongside new assignments in the 700 MHz and 3.5 GHz bands, will be crucial to meet the growing demand for data.

Aggregate spectrum costs in Bangladesh have risen significantly, with the spectrum-cost-to-revenue ratio increasing from 11% in 2014 to around 16% in 2023, driven by the acquisition of additional spectrum, currency depreciation and the relative spectrum scarcity. Bangladesh's spectrum-cost-to-revenue ratio (15.7%) exceeds the Asia Pacific median (10.4%) and is twice as high as the global median (7.7%). Additional revenue-based taxes and fees, such as the 5.5% revenue-sharing scheme with the regulator and 1% Universal Service Fund contribution, elevated the sector's tax burden to 22.2% of operators' revenue in 2023, with total taxes (including consumer taxes) reaching 55% of network operators' revenues, compared to a global average of 22%. This high-cost structure risks deterring investment and technology adoption.

Declining revenues per connection and growing spectrum needs have changed the fundamental value of spectrum

Globally and in Bangladesh, revenue per connection has declined due to market maturity and fierce competition. Between 2014 and 2023, inflation-adjusted revenue per mobile connection in Bangladesh fell by 38%, while spectrum holdings grew – reducing revenue per MHz by 69%.

These figures confirm the rapid decline in the commercial value of spectrum in Bangladesh and highlight the need for spectrum prices to fall to reflect current market realities. Historical pricing in Bangladesh tended to be higher compared to global benchmarks, inflated by currency depreciation and spectrum scarcity. The changing reality of the value of spectrum, along with the already high burden of spectrum and regulatory costs, means that prices will need to align with economic fundamentals. This adjustment is essential to ensure ongoing investment in the sector is forthcoming and to ensure efficient spectrum use.

A reduction of overall spectrum cost can boost network quality and bring billions of dollars of economic growth to Bangladesh

High spectrum costs have been shown to negatively impact consumer outcomes, such as network coverage and speeds. Conversely, lower spectrum costs enhance network investment, improving connectivity and supporting productivity, employment, and the digital economy.

We draw from this evidence by building an economic impact model to estimate the effects of future spectrum pricing decisions in Bangladesh. In particular, we outline three possible scenarios and assess their impact on network quality and economic growth by 2035:

- **Scenario 1 (reference scenario):** Maintaining current and historical prices would increase spectrum costs to 21% of operators' revenue in 2035, which would risk unsold or returned spectrum, limit 4G improvements and delay 5G rollout to reach only 86% of the population by 2035.

- **Scenario 2 (50% price reduction):** Reducing unit prices by 50% would align spectrum costs closer to the Asia Pacific median at about 12% by 2035, enabling improvements to networks to boost 4G speeds by 17% and allowing 5G coverage to reach 99% of the population by 2035. This will yield a cumulative $34 billion GDP boost ($20 billion from 4G improvements and $15 billion from accelerated 5G adoption).

- **Scenario 3 (75% price reduction):** Aligning costs with the global median of 8% of operators' revenue would enable network improvements to increase 4G speeds by 22% and accelerate 5G rollout, generating a $45 billion GDP boost ($26 billion from 4G improvements and $19 billion from accelerated 5G adoption).

Figure i

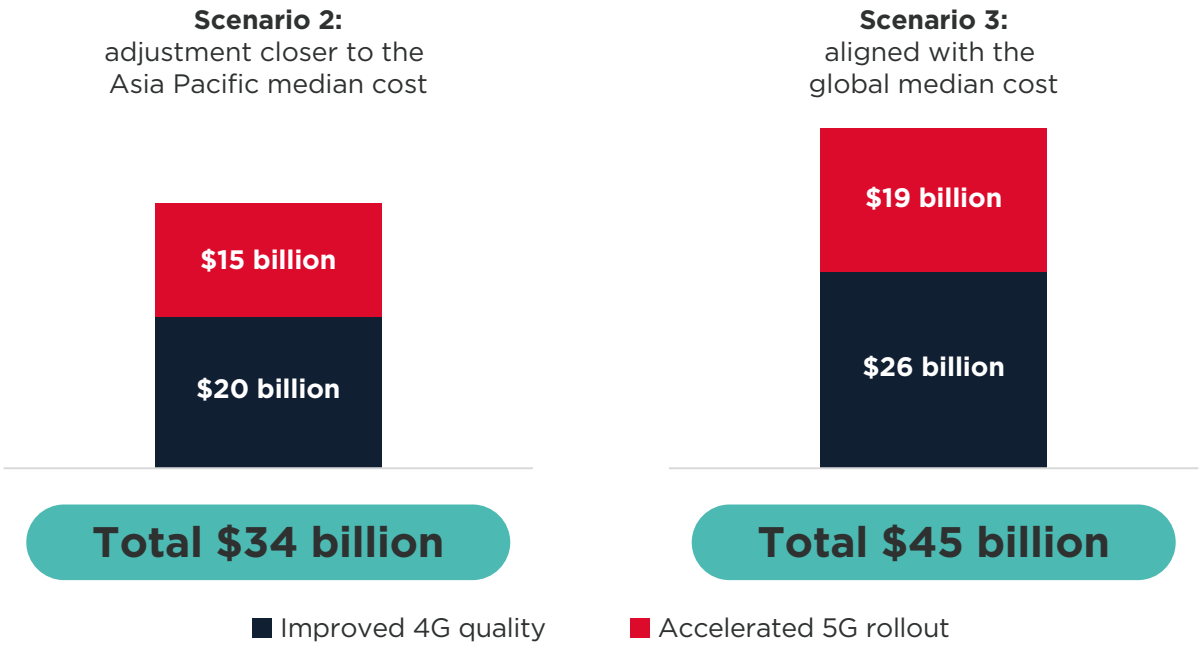
Impact of spectrum pricing on 4G network quality and 5G rollout

	Scenario 1: current and past prices (reference scenario)	Scenario 2: adjustment closer to the Asia Pacific median cost	Scenario 3: aligned with the global median cost
Spectrum cost	**21%** of operators' revenue	**12%** of operators' revenue	**8%** of operators' revenue
4G quality	Downscaled improvements to 4G networks	**17%** improvement in 4G network speeds relative to scenario 1	**22%** improvement in 4G network speeds relative to scenario 1
5G rollout	**8 million** connections by 2030; **86%** of the population covered by 2035	**12 million** connections by 2030; **99%** of the population covered by 2035	**13 million** connections by 2030; **99%** of the population covered by 2035

Source: GSMA Intelligence

Figure ii

Economic benefits of lower spectrum costs, relative to the reference scenario



Note: Totals may not add up due to rounding.
Source: GSMA Intelligence

High spectrum prices can result in unsold spectrum, leading to lower government receipts and unused spectrum

Direct government revenue from spectrum fees increases in proportion to unit prices. However, the possibility of unsold or returned spectrum means that the realised revenue could diminish for higher price levels. Returned or partly unsold spectrum are a likely outcome if prices are set based on past values or outdated benchmarks, as scenario modelling shows that the sale of all spectrum at these prices would take the aggregate spectrum cost to levels that cannot be justified by commercial fundamentals.

Lower spectrum costs can boost economic activity and increase the public sector's tax revenues, despite initially lower direct spectrum fee receipts

As our modelling shows, lower pricing can stimulate billions of dollars in economic growth, which in turn leads to higher overall tax revenues. However, it's important to note that this comparison does not account for the broader societal benefits. Economic impacts measured in terms of GDP should not be directly compared to changes in government revenue, as they reflect different dimensions of value.

Because of these wider benefits, pricing of spectrum should optimally be used to ensure efficient assignment, rather than to maximise government revenues, as public finances can be more efficiently boosted using other, more economically efficient forms of taxation.

To facilitate spectrum cost adjustment in Bangladesh, pricing needs to reflect the new fundamentals of spectrum value

The objective of regulators and governments is to maximise the social value of spectrum, which needs to consider the transformative effect of mobile connectivity on the broader economy. Hence, the approach to licence renewal and assignment of spectrum in Bangladesh should be guided by the considerations outlined in Figure iii.

In Bangladesh, the approach to pricing should minimise the risk of unsold spectrum

The existing high burden of regulatory costs translates into high uncertainty about the true value of spectrum in Bangladesh. Combined with the high opportunity cost of unsold spectrum, this calls for an approach that minimises the risk of unsold spectrum.

A crucial factor affecting spectrum value is the existing burden of spectrum and other regulatory costs. Previous research shows that these, along with other taxes and fees in Bangladesh, add up to 55% of network operators' revenue, over twice as high as the global average (22%).[1] This environment reduces the value of spectrum from the operators' perspective, hinders investment and introduces further uncertainty. Given the extremely high opportunity cost of idle radio spectrum generating no value to society, the approach to spectrum pricing should virtually eliminate the risk of unsold spectrum.

[1] GSMA Intelligence estimates, GSMA (2023) and GSMA (2019)

Figure iii

Considerations for spectrum licence renewal and new spectrum assignment in Bangladesh

Spectrum licence renewal

When relying on administrative processes for licence renewals, prices should not be linked to historical prices paid for a given assignment

- Renewal pricing should be structured to reflect the economic value of spectrum in Bangladesh, enabling operators to invest in network expansion while easing the regulatory cost burden.
- Using renewal fees to maximise government revenue will result in excess burden on operators and scaled down or delayed improvements to mobile networks. Conversely, easing the burden of spectrum cost can improve the viability of further investment, resulting in upscaled and accelerated deployment and enhanced consumer welfare.
- Lower pricing reduces the risk of returned spectrum during renewals. Returned spectrum comes with a significant opportunity cost: less spectrum for mobile networks leads to worse consumer outcomes.
- Renewal allows an opportunity to update licence terms, which can be used to provide additional flexibility and maximise the value of spectrum. This can include denomination in local currency to eliminate the exchange rate risk, maximising licence durations to provide certainty of access and providing flexible instalment options given the long-term period of return on spectrum.
- Spectrum is an intermediate input to deliver mobile services, yet in Bangladesh spectrum fees incur additional value-added tax (VAT), currently at 7.5%. From the perspective of public finances, there is equivalence between spectrum fees and VAT, as both directly raise revenue. However, exempting spectrum fees from VAT will prevent future changes to VAT unpredictably affecting the cost of scheduled instalments. This will help investment planning.

New spectrum assignments

When relying on auctions to assign new spectrum, regulators should not anchor reserve prices to historical prices – either those observed in Bangladesh in the past or in other markets

- Reserve prices should be set to discourage frivolous and tactical bidding, but not serve as a tool to maximise revenue. In practical terms, reserve prices should be set at a level that reduces the risk of unsold spectrum to negligible levels, avoiding the risk of idle bands and delayed network expansion.
- Reserve prices should be set in reference to the estimated fundamental value of spectrum. These fundamentals clearly show that the value of each MHz from the perspective of an operator has declined globally and in Bangladesh. Historical prices realised in previous assignments do not reflect the current reality of Bangladesh's mobile market.
- When relying on benchmarks, we recommend relying only on recent assignments that can give a large enough sample or using a price normalisation method that reflects the changing fundamentals of the value of spectrum. For example, this could mean adjusting historical benchmark prices in proportion to the change in the revenue per MHz per connection since the assignment.
- Licence terms should be supportive of long-term investment, such as extending licence durations to provide the necessary certainty, allowing flexible instalment plans or enabling the exchange of spectrum fees for commitment to coverage and quality obligations.

Source: GSMA Intelligence

1. Mobile connectivity in Bangladesh

Mobile connectivity plays a crucial role in supporting Bangladesh's development goals by leveraging digital technologies for economic growth, enhanced public service delivery and improved quality of life.

Bangladesh has made steady progress towards improved connectivity. Various metrics on the quality of infrastructure and intensity of mobile use (Figure 1) provide a range of comparisons to benchmark countries in the region. Major progress has been achieved to bring mobile broadband to nearly the entire population, with 99% 4G coverage. However, the intensity of use is lower compared to the peer group, as measured by mobile internet penetration (46% of the population) and data traffic (5 GB per connection per month). This can in part be attributed to the relatively lower device readiness in Bangladesh. As of 2025, 40% of users still rely on basic and feature phones that cannot support mobile internet use cases. Hence, it is unsurprising that 5G rollout in Bangladesh has not yet been a viable option, though readiness will start improving in the next few years. As more users acquire 4G- and 5G-capable handsets, favourable conditions for increased investment in network capacity will be essential to ensure that consumers and the economy can benefit from improved connectivity.

In comparison to other countries, Bangladesh scores well on the affordability metrics. The average subscription cost and cost of a data bundle are lower as a share of average income compared to the peer group. This shows that pricing of mobile services is driven by competitive market conditions and should foster increasing adoption and intensity of use.

However, from the perspective of operators and investors, low revenues per connection can pose a challenge if combined with the high cost of spectrum and other regulatory costs. Easing the burden of these costs can improve the viability of further investment to bring infrastructure improvements and realise the economic growth potential brought by mobile connectivity.

Figure 1

Benchmarking the mobile connectivity indicators

Source: GSMA Intelligence

2. The role of spectrum availability and its cost

Radio spectrum is vital to the operations of mobile networks

Mobile network throughput depends on the amount of spectrum available:

- With more spectrum, operators can deliver higher throughput and better network quality. This is grounded in physics and the limits of how much data can be transmitted over a given frequency range.
- Alternatively, with more spectrum, networks can achieve the same throughput but with fewer cell sites and lower investment in physical capital such as land, towers and antennas.

Different spectrum bands have different characteristics. Some radio bands can allow for efficient expansion of mobile coverage across large areas (frequently achieved using sub-1 GHz bands), while others (higher bands) can be used to enhance network capacity in densely populated areas. As different bands complement each other, network operators seek efficient operation by using a combination of different bands.

Renewal of existing spectrum and new spectrum releases will be key to keeping up with data demand in Bangladesh

The spectrum needs of mobile operators have drastically grown in the past decade, owing to increased adoption rates and the intensity of use driven by the latest use cases, such as video calling, streaming and mobile apps and services. As shown in Figure 2, Bangladesh's operators rely on just over 500 MHz of spectrum. This amount is lower than that of most other countries in Asia Pacific, despite the recent welcome additions of spectrum in the 2.3 and 2.6 GHz bands. This is because many countries have already been able to make use of the full capacity of the new bands (700 MHz, 3.5 GHz etc.), either to roll out 5G or to enhance the capacity of 4G networks.

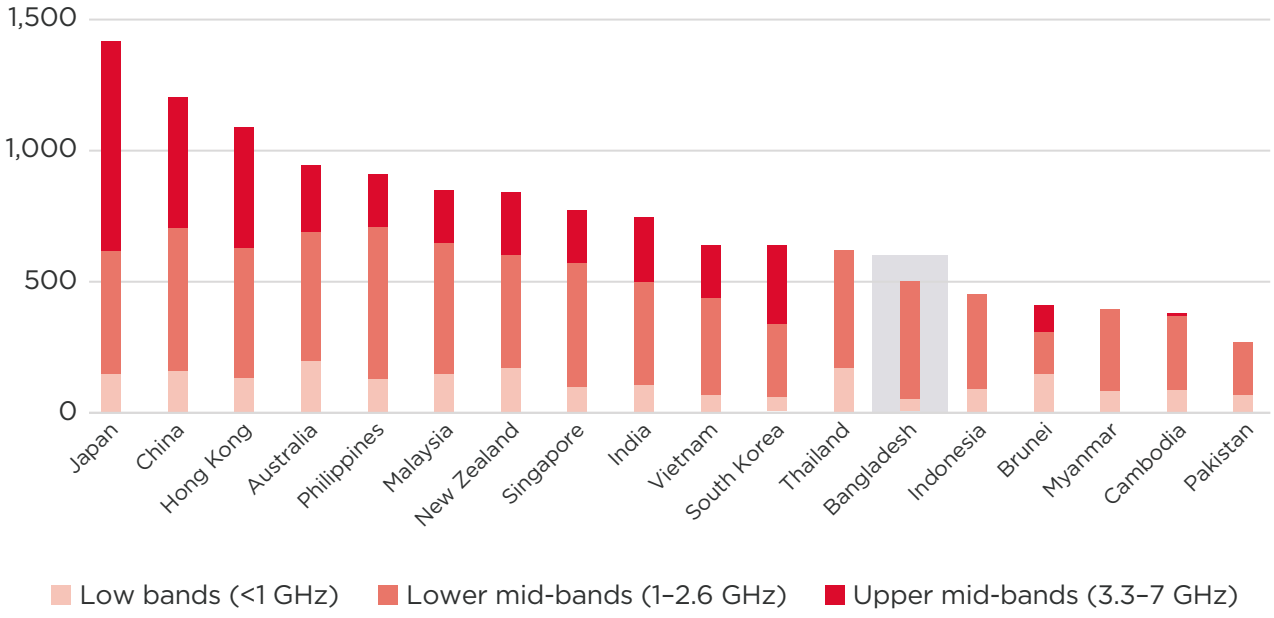
To ensure sufficient supply of spectrum, it is important that the planned renewals and assignments of new spectrum are successful, securing long-term access to existing bands and the timely expansion of the supply of spectrum in new bands. In the most immediate term, these include:

- the planned renewal of licences expiring in 2026 in the 900 MHz, 1.8 GHz and 2.1 GHz bands
- the planned assignments of spectrum in new bands (700 MHz and 3.5 GHz).

Figure 2

Comparison of spectrum assigned to mobile operators in Asia Pacific, 2024

Amount of spectrum assigned to mobile operators (MHz)



Source: GSMA Intelligence

Over the past decade, the total cost of spectrum in Bangladesh has increased

How to measure spectrum cost accumulation

We measure aggregate spectrum cost by calculating a ratio of spectrum cost to network operators' recurring (subscription) revenue (spectrum-cost-to-revenue ratio). This ratio provides an aggregate estimate of spectrum cost based on all active licences in a given year, taking into account upfront fees (amortised over the licence duration) and any annual or one-off spectrum-related fees. It does not consider any other fees, such as taxes, operating licences or the cost of meeting obligations attached to licences.

Figure 4 illustrates the trends in Bangladesh of mobile operators' recurring revenues, spectrum cost and the resulting spectrum-cost-to-revenue ratio. Growth in the aggregate spectrum cost has outpaced revenues, leading to an increase in the ratio, from 11% in 2014 to 16% by 2023.

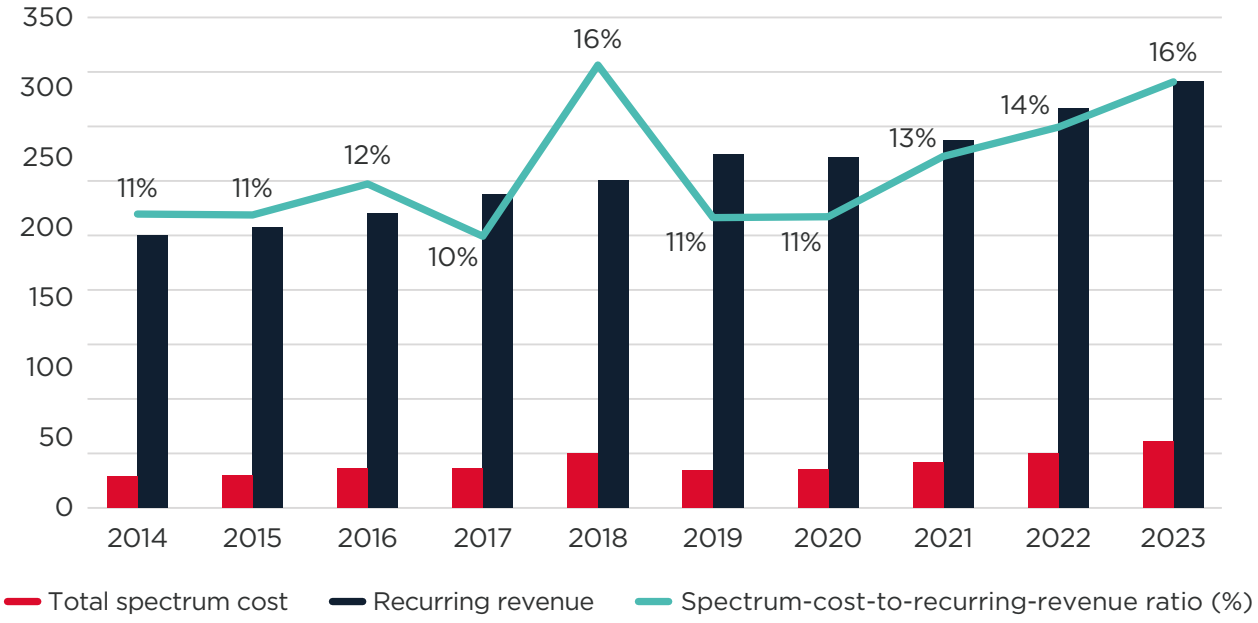
The increase in spectrum cost can be attributed to multiple factors. First, to deliver capacity and bring 4G networks to consumers, operators acquired additional spectrum. Second, prices of renewed licences have been directly set at a high level by the regulator. Third, rapid depreciation of the Bangladeshi taka has meant that the cost of spectrum fee instalments, which for many licences were denominated in US dollars, has rapidly increased in recent years. Mobile operators also pay annual operating licence fees, though these account for a smaller share of the total cost.

Additionally, it is likely that the approach to pricing in many instances has led to increased prices paid by the operators. High reserve prices have led to unsold spectrum, which in turn created a relative spectrum scarcity and could have worsened the 'winner's curse', which arises from uncertainty about the true value of spectrum, resulting in overestimation of the value of spectrum. In such cases, the auction winner may acquire spectrum at inflated reserve prices but find themselves financially constrained with a limited ability to invest in network deployment. In contrast, during an auction where competitive bidding takes place, the winner pays only slightly above the next-

Figure 4

Spectrum costs in Bangladesh have increased significantly in recent years

Total spectrum cost and recurring revenue (BDT, billion)



Note: Based on data for the three largest operators in Bangladesh, excluding Teletalk.
Source: GSMA Intelligence estimates based on GSMA Intelligence data

highest bidder's valuation. This reduces the risk of significantly overpaying relative to the item's true value because it is less likely that multiple operators will independently overestimate the value of spectrum.

During the same 2014–2023 period, network operators' revenues have increased in nominal terms, though in inflation-adjusted (real) terms these have largely remained flat. This is because while the number of connections has increased, revenue per connection has declined. This trend of declining or flat revenues is not isolated to Bangladesh, as revenue per connection has rapidly declined in most markets due to fierce competition and the increasing share of economic value of improved connectivity being captured by content and application providers and consumers, rather than network operators.

The increase in the aggregate spectrum cost in recent years means that Bangladesh has one of the highest spectrum-cost-to-revenue ratios in the world. As shown in Figure 5, the ratio in Bangladesh is above the median in Asia Pacific (10.4% of operators' recurring revenue), and twice as high as the global median (7.7%).

Additional revenue-based taxes and fees increase the tax burden on the mobile sector in Bangladesh

It is important to interpret these figures in the context of the broader tax environment the mobile sector faces in Bangladesh. Besides spectrum costs, operators face additional sector-specific, revenue-based charges: revenue sharing with the Bangladesh Telecommunication Regulatory Commission (BTRC) (5.5% of revenue) and contributions to the Universal Service Fund (1% of revenue). Together with spectrum costs, this amounted to 22.2% of operators' revenue in 2023.

These charges apply regardless of whether an operator is profitable. Further sector-specific corporate tax rates apply to any profit (charged at 40% or 45%, depending on whether the company is publicly listed) and companies incurring losses or earning minimal profits are subject to a minimum turnover tax of 1.5% (changed in the recent budget, previously 2%) on their revenue, if this amount exceeds the applicable corporate income tax amount. These rates are higher compared to most countries in the region, and combined with other types of taxes, these account for

55% of network operators' revenue, over twice as high as the global average of 22%.[3] At such a high level, taxes and charges can have a detrimental effect on the viability of investment into further spectrum and the necessary infrastructure upgrades to utilise it.

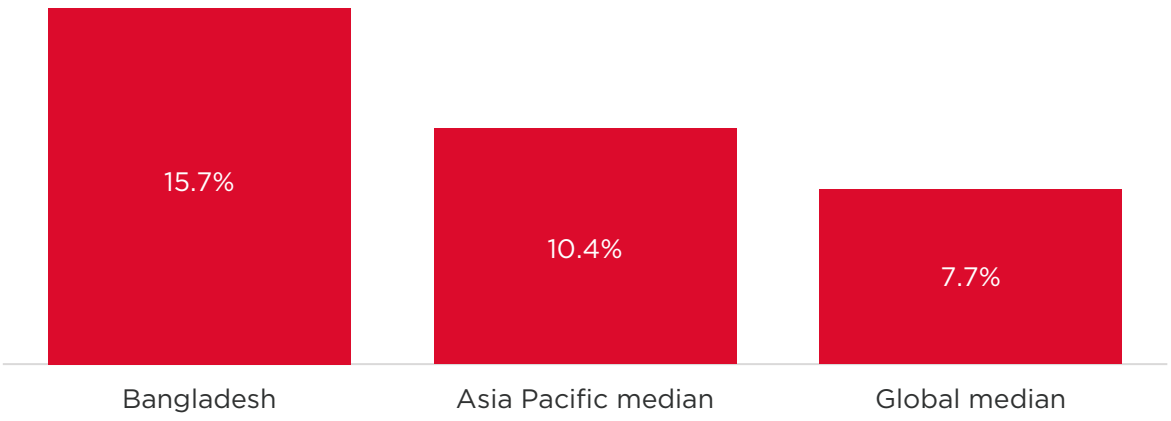
Consumption tax on mobile services in Bangladesh currently stands at 39%.[4] This substantial tax burden inserts a wedge between what consumers pay and what the market-driven prices would have been.

Ultimately, high taxes discourage the adoption of technology that is transformative to the economy and brings benefits beyond what the GDP measures, including the creation of new jobs and improved wellbeing of society. At the same time, lower post-tax revenues constrain operators' ability to absorb spectrum costs and ultimately limit their capacity to offer affordable connectivity to consumers.

Figure 5

The spectrum-cost-to-revenue ratio in Bangladesh exceeds the regional and global averages

Spectrum cost as a share of operators' recurring revenue



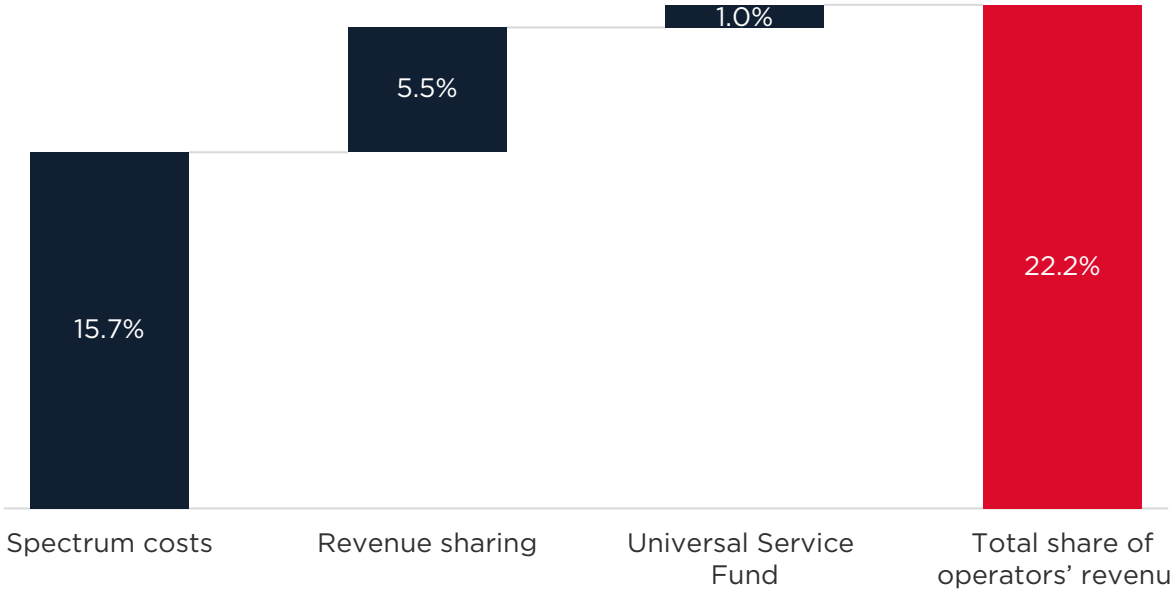
Note: The figure for Bangladesh is based on data for the three largest operators, excluding Teletalk. Asia Pacific and global medians are based on countries where data was available.

Source: GSMA Intelligence estimates based on GSMA Intelligence data

[3] GSMA (2023) and GSMA (2019)
[4] Grameenphone (2024)

Figure 6

Revenue-based taxes and fees in Bangladesh account for over a fifth of operators' revenue



Source: GSMA Intelligence estimates, GSMA (2023) and GSMA (2019)

Table 1

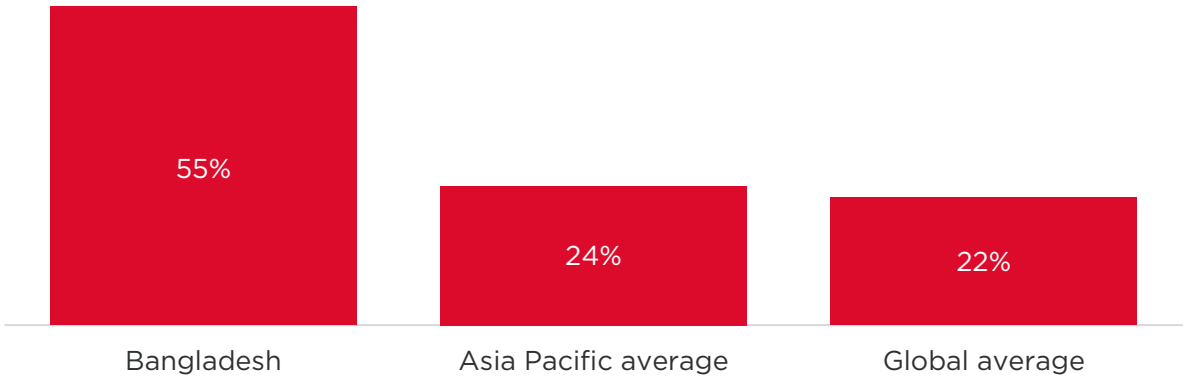
Sector-specific corporate tax rates in Bangladesh are higher than those of most countries in Asia Pacific

Country	Corporate tax on the mobile sector
Bangladesh	40/45% (depending on whether the company is publicly listed)
India	35%
Pakistan	29%
Sri Lanka	28%
Nepal	25%
Myanmar	25%
Malaysia	24%
Thailand	20%
Vietnam	20%
Cambodia	20%
Laos	20%
Brunei	19%

Source: GSMA Intelligence estimates, GSMA (2023) and GSMA (2019)

Figure 7

Total taxes and fees in Bangladesh as a share of mobile-sector revenues is more than double the Asia Pacific and global averages



Source: GSMA Intelligence estimates, GSMA (2023) and GSMA (2019)

Case study

How Brazil's multiband auction delivered spectrum to power the rollout of 5G

The multiband auction in Brazil in 2021 was designed to address demand for mid-band 5G spectrum. Spectrum availability was achieved through long-term planning of the relocation of legacy satellite services. Thanks to this, Brazil was able to offer 400 MHz in the 3.5 GHz band and pave the way for future use of frequencies in the 3.8–4.2 GHz range.

The process of laying the policy foundations for the auction started much earlier. In 2019, Brazil updated its telecoms regulations, which set out:

- a longer licence term of 20 years (previously 15 years)
- a secondary spectrum market to allow the trading and leasing of licences
- unlimited renewal terms based on a presumption-of-renewal approach.

These conditions allowed for the maximisation of the value of spectrum from the perspective of future users. Taken together, these actions built an attractive proposition to operators, which could maximise the value of spectrum and pick from the menu of options that serve the market best.

The auction attracted 15 entities, with competitive bidding leading to nearly all the frequencies being awarded, the exception being elements of the mmWave band. A year after the award of spectrum, operators requested permission to deploy 1,400 antennas – three times the number required by licence conditions. As of the end of 2024, almost 38,000 5G base stations had been deployed, reaching nearly 95% population coverage.[2]

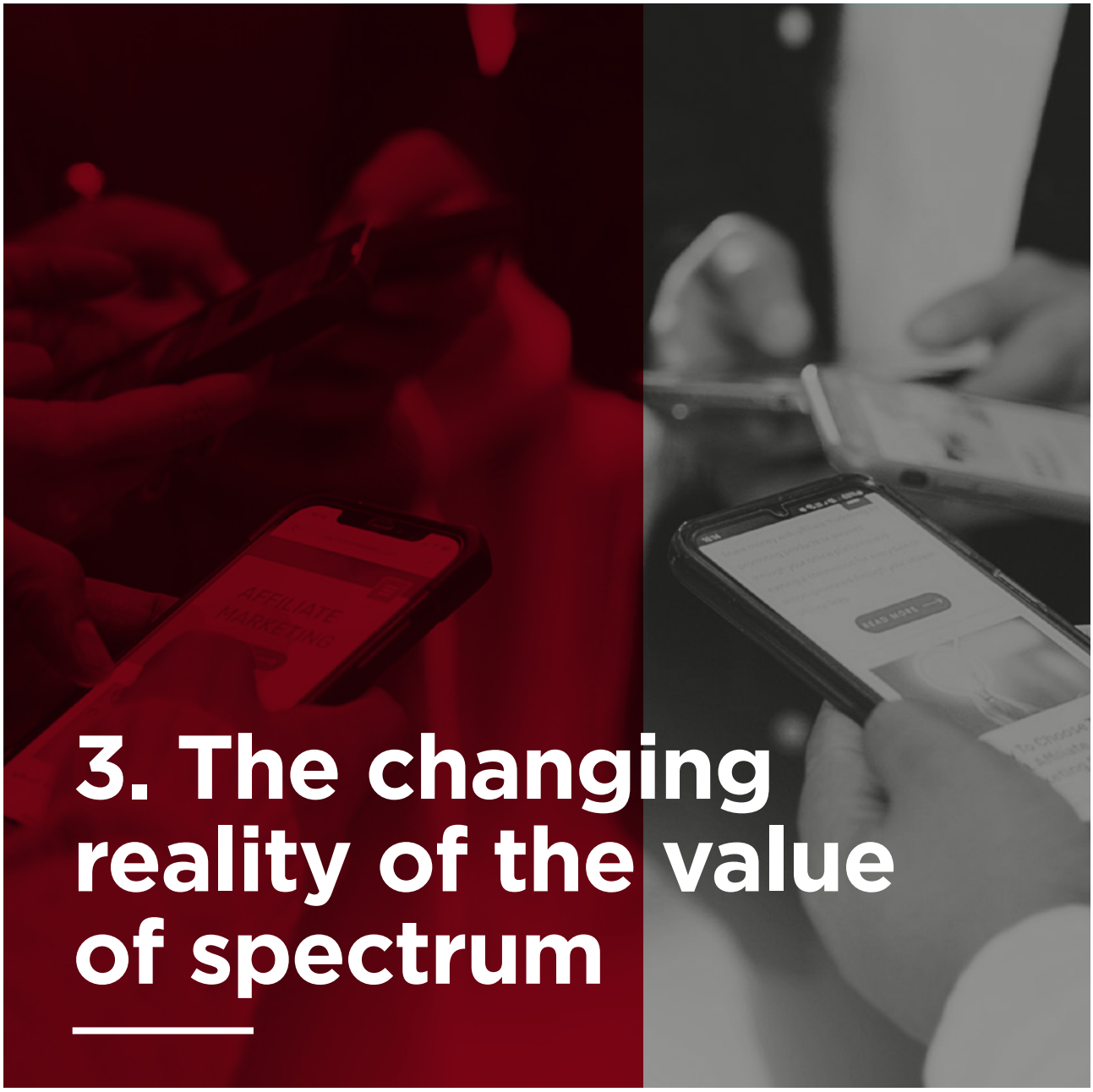
The approach to ensuring the success of the auction was a big step forward for Brazil. It emphasised cooperation among regulators, operators, vendors, broadcasters, academia and other stakeholders.

Figure 3

Brazil's approach to spectrum licensing and auctions

Source: GSMA Intelligence

[2] Estações do SMP, Anatel



3. The changing reality of the value of spectrum

A global trend of declining revenue per connection

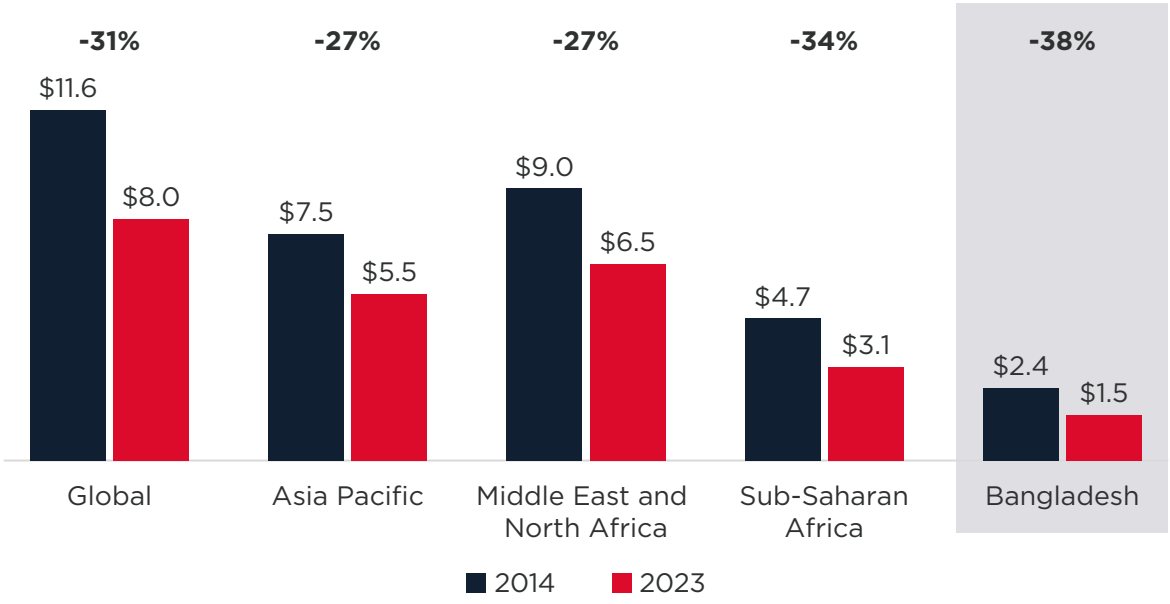
Revenues per connection have declined globally, with a similar rate of decline observed in Bangladesh (Figure 8). This can be attributed to mobile services becoming a mature market, with high levels of competition driving down prices; mobile reaching the lower end of the consumer market and providing services to lower-income consumers; a greater proportion of the economic value being captured by content providers rather than mobile operators; and regulatory restrictions and price caps in some countries.

While this decline is welcome from the perspective of consumers, it fundamentally changes the value of spectrum from the operators' perspective. Operators need even more spectrum than a decade ago to support each connection and, at the same time, each connection generates less revenue, so the commercial value of each MHz of spectrum has rapidly declined. This has already started translating into lower prices that operators are able to pay globally (Figure 9), with steep declines in unit prices. This shows that the past prices and values of spectrum are not indicative of its current value, given the change in economic fundamentals.

Figure 8

Revenue per connection declined globally between 2014 and 2023

Average monthly revenue per connection (inflation-adjusted)

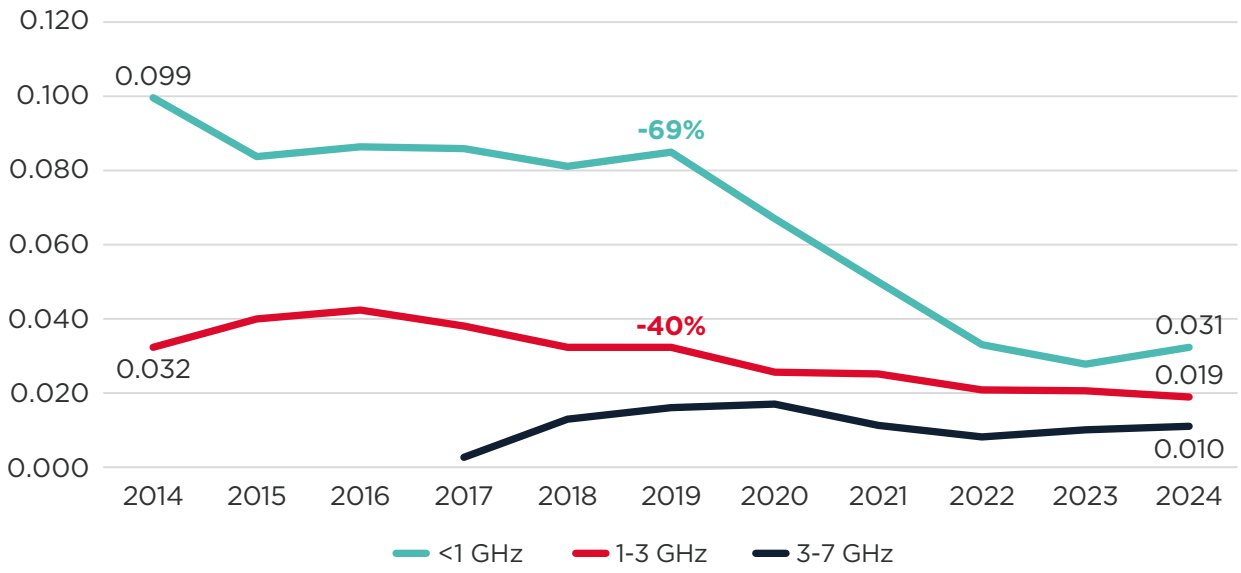


Note: The figures for Bangladesh are based on data for the three largest operators, excluding Teletalk.
Source: GSMA Intelligence estimates based on GSMA Intelligence data

Figure 9

Spectrum prices are adjusting down globally

Average spectrum price per MHz ($2023 PPP/MHz/year/population)



Source: GSMA Intelligence estimates based on GSMA Intelligence data (global sample, three-year rolling average after removal of outliers). WACC-adjusted figures.

The drop in revenue per subscriber and the growth in spectrum holdings have led to steep declines in the revenue each MHz of spectrum supports

Declining revenue per MHz is evident across all regions (Figure 10 shows this for Asia Pacific and Bangladesh specifically).

This has two implications:

- The value of each unit of spectrum to operators has declined in recent years, in proportion to the change in market revenue that each MHz can support.
- Prices for spectrum licences will need to respond by falling. However, prices paid by operators for spectrum licences are often driven by non-market factors, so this may not have fully materialised yet.

Given these changes in fundamentals of the value of spectrum, spectrum prices in Bangladesh will need to fall to reflect the current and future commercial fundamentals.

Historically, spectrum prices in Bangladesh tended to be higher than international benchmarks from recent years, whether expressed in terms of population (BDT/MHz/year/population) or per unit of revenue terms (BDT/MHz/year/BDT million of recurring revenue). This difference can be attributed to:

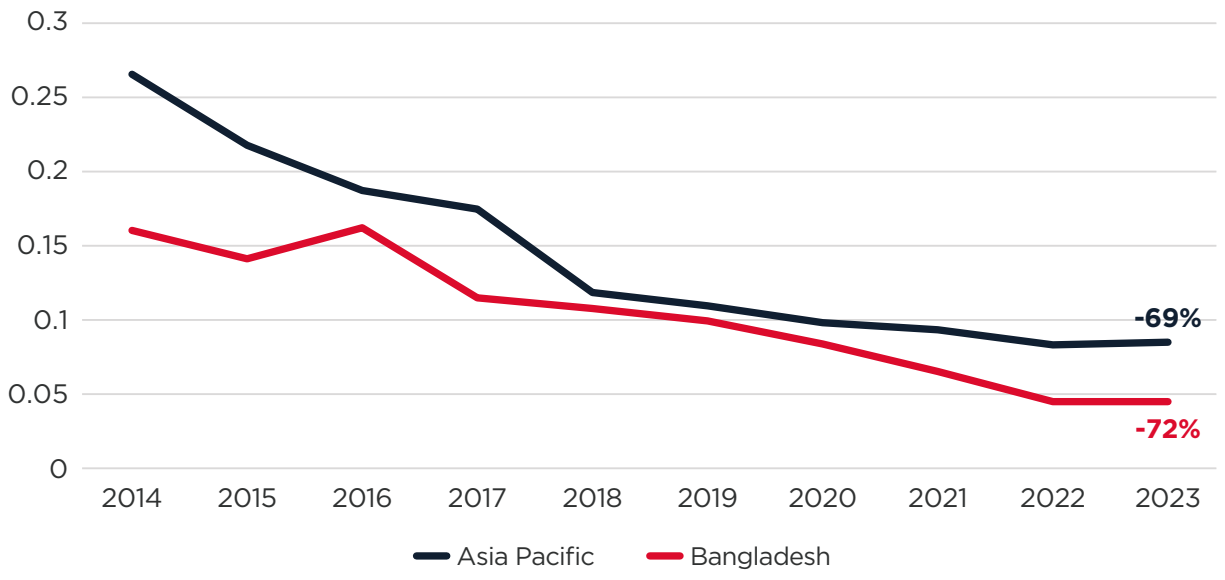
- the effect of national currency depreciation, which has increased the taka value of spectrum licence instalments denominated in US dollars
- high unit prices directly set by the regulator during renewals of licences
- the relative spectrum scarcity in Bangladesh, which can drive unit prices up (previous research shows that 10% less spectrum available results in 10% higher prices).

These factors were outside of operators' control. The recent shift to denominating spectrum pricing in Bangladeshi taka is a welcome change that eliminates the exposure to the currency exchange risk. However, the build-up of spectrum and other regulatory costs in Bangladesh will continue to affect the value operators place on spectrum in the years to come.

Figure 10

Decline in revenue per MHz per connection in Asia Pacific and Bangladesh

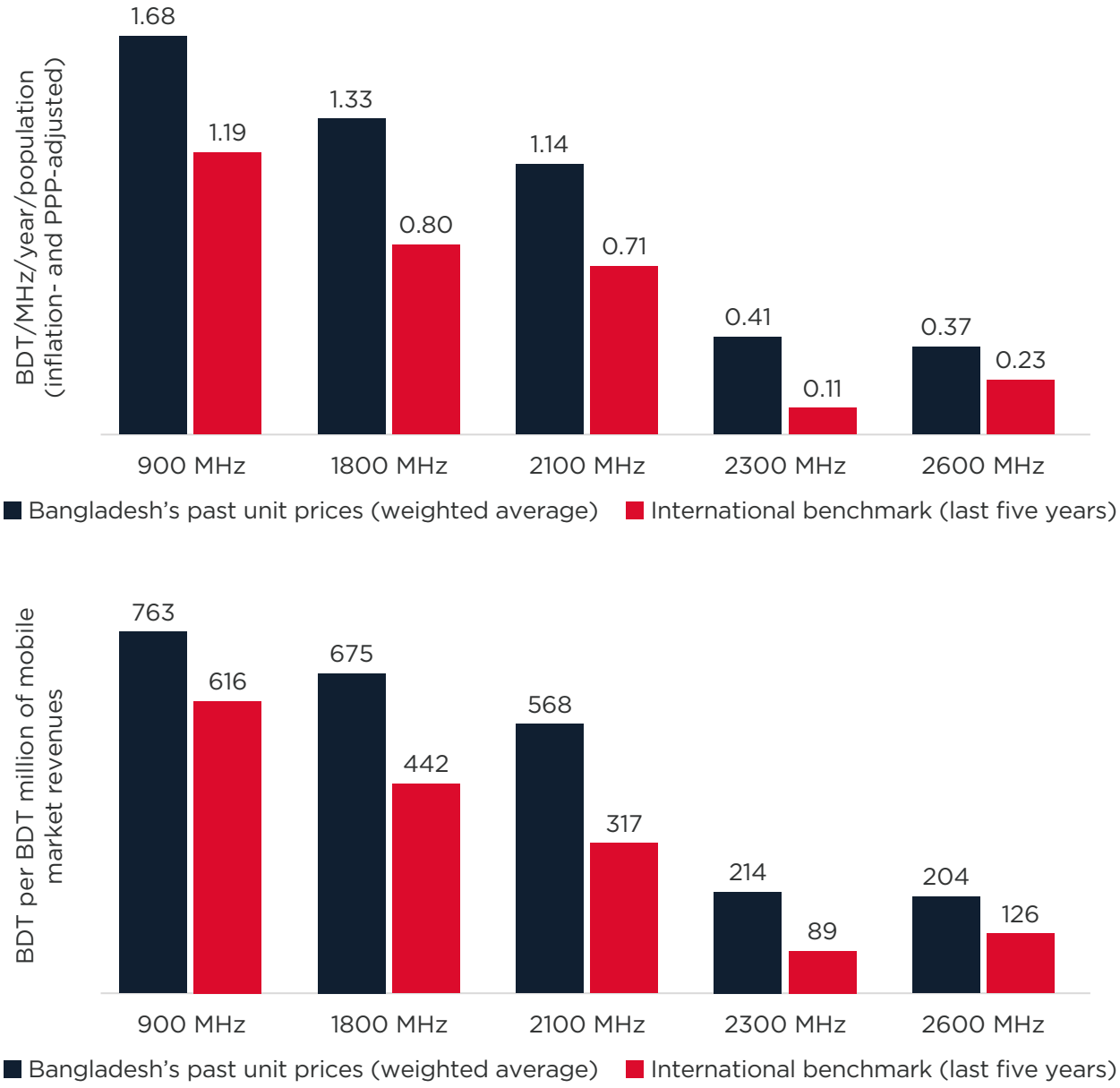
Monthly recurring revenue per MHz per connection ($2023/MHz/connection, inflation-adjusted)



Note: The figures for Asia Pacific are presented as a connection-weighted average.
Source: GSMA Intelligence estimates

Figure 11

Historical unit price benchmarks: Bangladesh versus the global median



Note: PPP denotes purchasing power parity in Bangladesh's 2023 prices. Benchmarks for Bangladesh are based on assignments excluding pre-2007 concessions.
Source: GSMA Intelligence analysis based on the GSMA Intelligence Spectrum Navigator database and data provided by mobile operators in Bangladesh

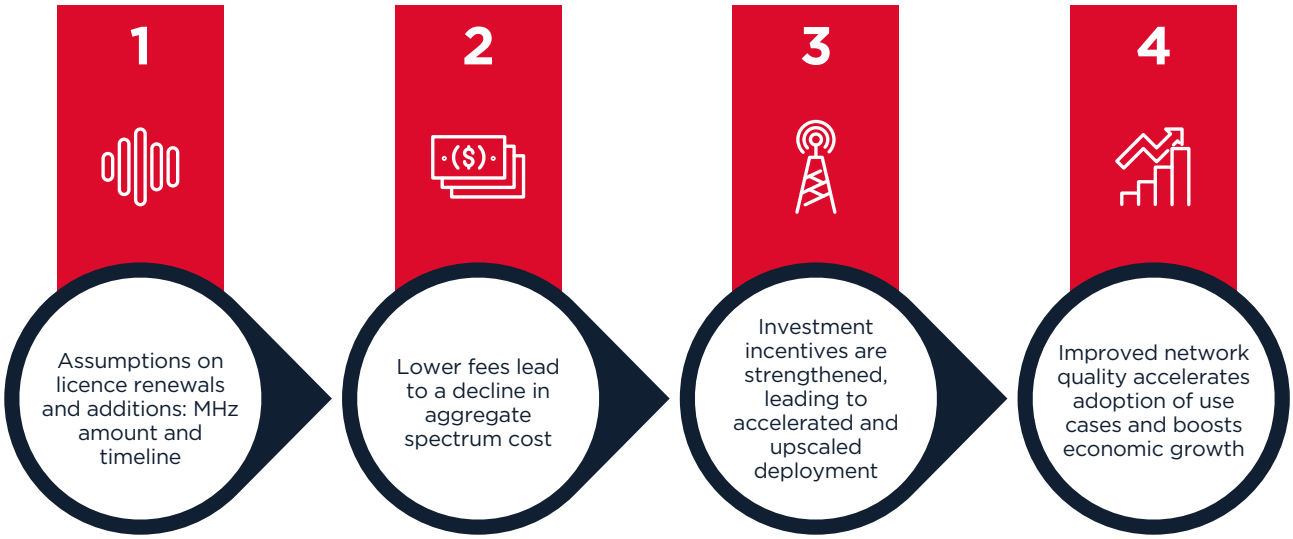
4. Modelling the impact of spectrum pricing in Bangladesh

When the spectrum cost does not reflect its underlying value, it leads to distorted investment incentives for operators, resulting in potential underdevelopment of networks and further adverse impacts as a result of missed opportunities for economic growth brought by improved connectivity. Conversely, lower spectrum costs increase the viability of network investment, improving connectivity and supporting productivity, employment and the digital economy. This is confirmed by earlier empirical studies showing that lower spectrum costs positively impact metrics such as coverage and network speeds.[5]

To examine how different pricing scenarios can translate into economy-wide impacts, we rely on economic modelling. As shown in Figure 12, we formulate cost scenarios grounded in the new spectrum and renewal roadmap for Bangladesh and different price assumptions (steps 1 and 2). We then model economic impacts using the existing evidence on the relationship between spectrum cost and network quality (step 3) and between network quality and economic growth (step 4).[6]

Figure 12

How spectrum pricing is linked to economic growth



Source: GSMA Intelligence

[5] The impact of spectrum assignment policies on consumer welfare, Bahia and Castells, 2022
[6] A detailed description of the approach to modelling and sources of assumptions is provided in the Appendix.

Table 2

Modelled spectrum pricing scenarios

Scenario	Description
Scenario 1: current and past prices (reference scenario)	Operators pay prices aligned with average past unit prices (per MHz/year/population (inflation-adjusted)), extrapolated across new bands using relative band price ratios based on international benchmarks.
Scenario 2: adjustment closer to the Asia Pacific median cost	Prices in upcoming assignments and renewals decrease by 50%, preventing further build-up in spectrum cost. Spectrum cost gradually declines closer to the Asia Pacific median cost.
Scenario 3: aligned with the global median cost	Unit prices decrease by 75%, which aligns the spectrum-cost-to-revenue ratio to about 8%, similar to the global median.

Source: GSMA Intelligence analysis and assumptions

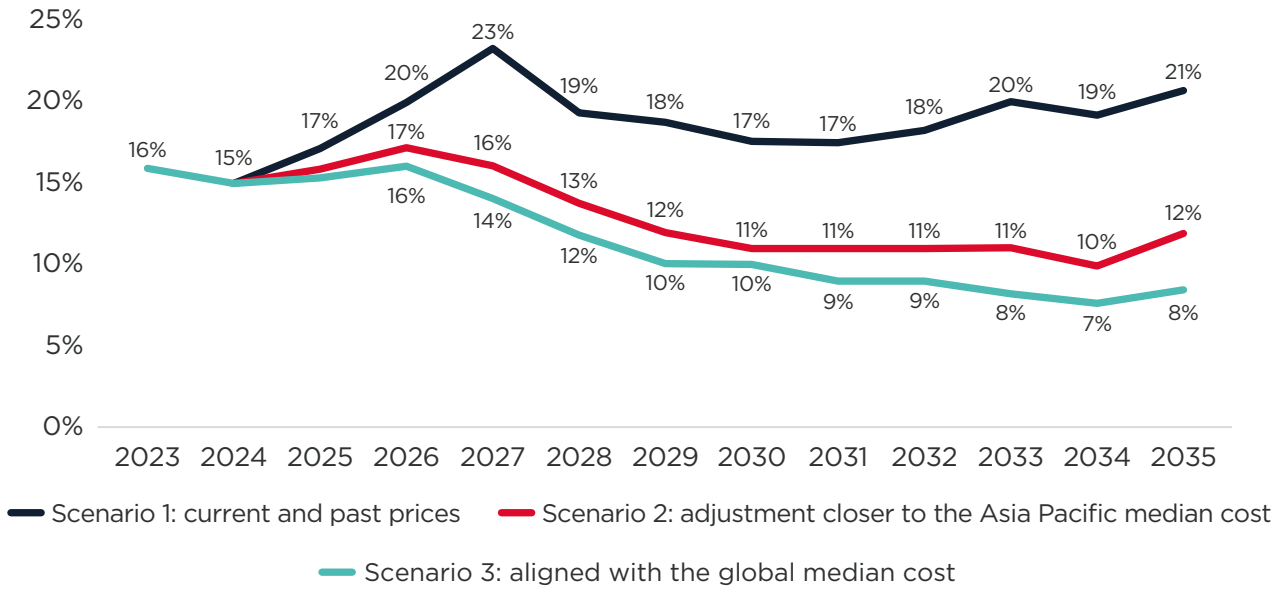
We rely on three illustrative pricing scenarios for Bangladesh (Table 2). All three scenarios assume that all planned spectrum assignments and renewals will result in the assignment of all available spectrum, leaving no unsold lots. However, it is also plausible that high prices could result in unsold or returned spectrum. As it is not possible to judge a price level at which this would occur, we do not examine scenarios under which spectrum remains unsold. However, evidence shows that unsold or returned spectrum will lower spectrum availability, leading to negative impacts on both coverage and network speeds. Hence, the impact of avoiding unsold and returned spectrum could be similar to the examined impacts of allowing cost adjustment.

These assumptions on unit prices translate into projections of total spectrum cost expressed in terms of operators' recurring revenue (Figure 13):

- **Under scenario 1**, the renewal and sale of new spectrum at current and past unit prices would translate into a steep increase in spectrum cost, reaching 23% of operators' recurring revenues in 2027, before settling at 21% in 2035. However, it is possible that this level of spectrum cost would not be tolerable to operators. Pricing of spectrum at such levels could result in partly returned or unsold spectrum. While we do not specifically assess economic impacts of such an event, evidence shows that a reduction in the amount of available spectrum would negatively impact network quality.
- **Under scenario 2**, which assumes a decline in unit prices by 50%, the aggregate spectrum cost would initially still increase as a result of the addition of new bands, but gradually it would decrease to about 12% by 2035, which is still above the current median spectrum cost in Asia Pacific.
- **Under scenario 3**, the assumed decrease in unit prices (75% lower) is approximately equal to the decline in revenue per MHz between 2014 and 2023 (69% lower). Under this assumption of full spectrum price adjustment, the aggregate spectrum cost would gradually decline to a level similar to the global median, at about 8% of operators' revenue.

Figure 13

Projected spectrum cost in Bangladesh as a share of operators' recurring revenue



Source: GSMA Intelligence

Based on these scenarios and further modelling steps, we examine the impacts of spectrum cost on the quality of mobile networks in Bangladesh. Presented impacts are assessed as the difference from the reference scenario (scenario 1), which is grounded in past prices.

We find that under scenario 2, adjustment of spectrum cost to levels just above the Asia Pacific median could improve the viability of investment in mobile networks, supporting upscaled network deployment. This will result in 17% higher 4G network speeds and accelerated 5G rollout, increasing the number of connections to 12 million in 2030 and increasing the network coverage to 99% of Bangladesh's population by 2035, compared to only 86% of the population covered under scenario 1.

Under scenario 3, the lower spectrum cost could result in an even greater stimulus to investment in network improvements. We estimate that, as a result, 4G network speeds in Bangladesh could be 22% higher compared to scenario 1 and the rollout of 5G could be accelerated even further.

Improvements in the availability and the quality of mobile connectivity have an overarching transformative effect, supporting productivity-boosting use cases and the emerging branches of the digital economy. Under assumptions informed by the previous literature on the impact of generational upgrade and increasing speeds, we estimate the following impacts (in comparison to the reference scenario):

- **Under scenario 2**, there would be a cumulative boost to GDP of around $34 billion between 2025 and 2035, arising from improvements to 4G quality ($20 billion) and the accelerated 5G rollout ($15 billion).
- **Under scenario 3**, there would be a cumulative economic impact of around $45 billion, arising from improvements to 4G quality ($26 billion) and the accelerated 5G rollout ($19 billion).

These figures show the substantial potential of spectrum policy to influence the broader economy beyond the mobile sector alone. Moreover, the benefits of improved connectivity stretch beyond GDP and economic growth, boosting employment, wellbeing and the informal economy.

Figure 14

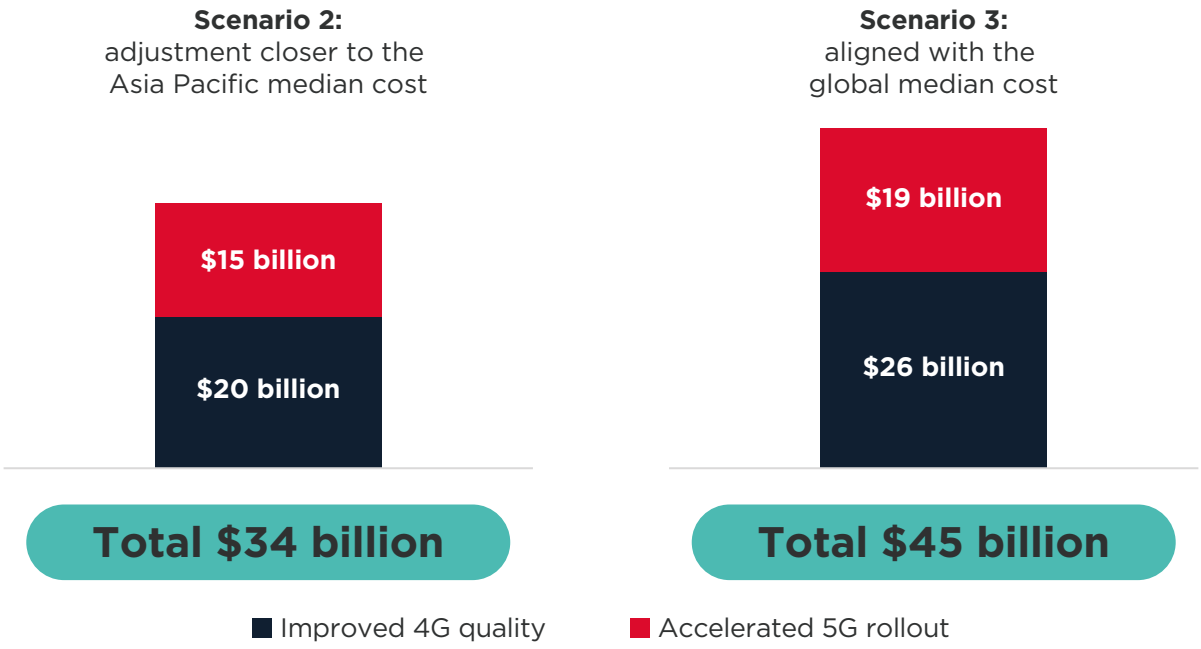
Impact of spectrum pricing on 4G network quality and 5G rollout

	Scenario 1: current and past prices (reference scenario)	Scenario 2: adjustment closer to the Asia Pacific median cost	Scenario 3: aligned with the global median cost
Spectrum cost	**21%** of operators' revenue	**12%** of operators' revenue	**8%** of operators' revenue
4G quality	Downscaled improvements to 4G networks	**17%** improvement in 4G network speeds relative to scenario 1	**22%** improvement in 4G network speeds relative to scenario 1
5G rollout	**8 million** connections by 2030; **86%** of the population covered by 2035	**12 million** connections by 2030; **99%** of the population covered by 2035	**13 million** connections by 2030; **99%** of the population covered by 2035

Source: GSMA Intelligence

Figure 15

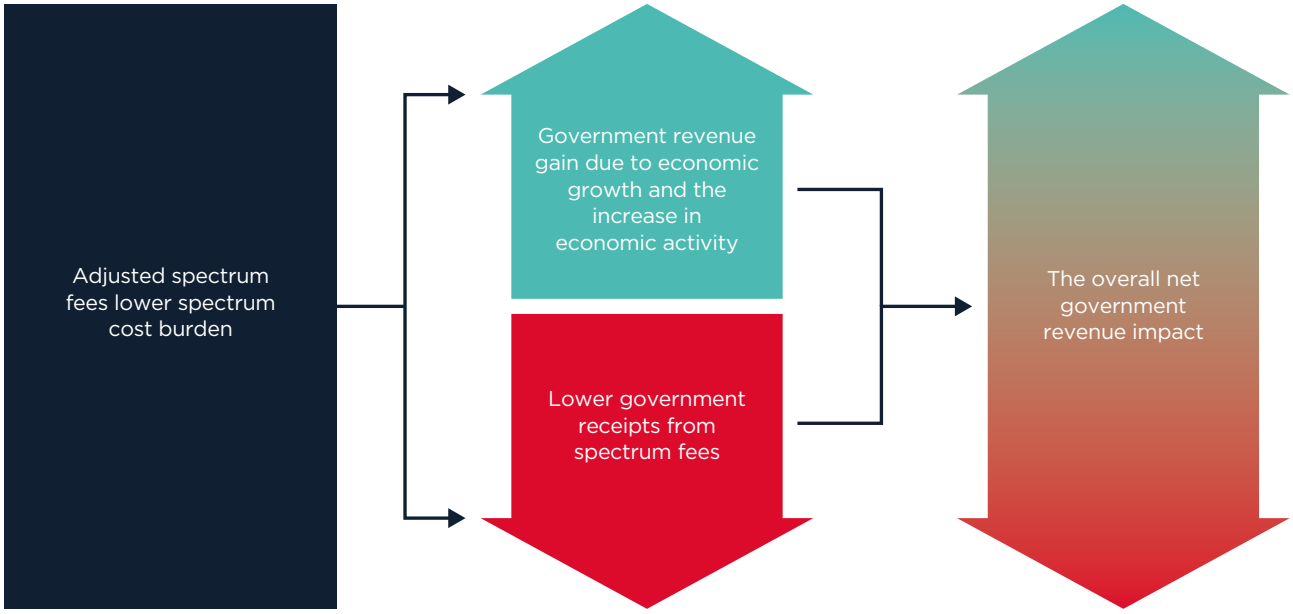
Economic benefits of lower spectrum costs, relative to the reference scenario



Note: Totals may not add up due to rounding.
Source: GSMA Intelligence

Figure 16

The impact of lower spectrum fees on public finances



Source: GSMA Intelligence

Increased economic activity in low-pricing scenarios could boost public finances, offsetting the effect of lower direct spectrum fee receipts

As shown, in Figure 16, the net impact of spectrum pricing on government finances depends on the relative magnitude of two effects:

- **Direct revenue from spectrum fees, which increases in proportion to unit prices.** However, the possibility of unsold or returned spectrum means that the realised revenue could diminish for higher price levels. Recent examples of this occurring include an operator in Mexico returning spectrum due to an increase in fees and unsold spectrum during Vietnam's 5G spectrum auction.

- **Indirect effect on revenues due to the lower level of economic growth and smaller tax base compared to lower-cost scenarios.** Quantification of such an effect is complex, but given the overarching impact of mobile connectivity on all economic sectors, this could mean lower receipts from income, consumption and corporation taxes.

The net effect of different pricing scenarios on public finances is therefore subject to uncertainties. Importantly, this comparison does not consider the net benefits to wider society, as the economic impacts measured in terms of GDP should not be compared to government revenue impacts. Nevertheless, because of these wider benefits, pricing of spectrum should optimally be used to ensure efficient assignment rather than to maximise government revenues, as public finances can be more efficiently boosted using other, more economically efficient forms of taxation.

5. Conclusions and recommendations

The economic fundamentals of the value of spectrum have changed

Operators require more spectrum, but each MHz supports less revenue compared to a decade ago. Despite the expansion of mobile network capabilities and their value to consumers, average revenue per connection has declined. At the same time, each connection requires more spectrum, driving network operators to acquire further spectrum. In Bangladesh, inflation-adjusted average revenue per connection has declined by 38% between 2014 and 2023, while the Inflation-adjusted market revenue per MHz of spectrum has decreased by 69%. The same trends are observed globally, indicating a decline in the commercial value of spectrum to operators.

Currently, the spectrum cost in Bangladesh accounts for 16% of operators' revenue, which is one of the highest figures globally and twice the global average. This has been driven by high unit prices directly set by the regulator in a revenue-centric approach, the effect of depreciation of the Bangladeshi taka (as historically Bangladesh has set spectrum price in US dollars) and a relative scarcity of spectrum, which has driven unit prices up in the recent auction-based assignments.

Allowing spectrum prices to adjust to the new reality will ensure that the benefits of improved connectivity are maximised

Our modelling results show that renewal of licences and the planned sale of further spectrum at prices seen in the past would lead to an even greater spectrum cost burden, reaching 22.2% of operators' revenue. However, at such high price levels, it is possible that operators could choose to return the existing holdings and not acquire further spectrum, leading to a substantial opportunity cost of unused spectrum. While it is not possible to precisely determine the price level at which operators would return spectrum, this is determined by the economic fundamentals and occurs when the cost of investment in spectrum and hardware is higher than the potential return it could generate in the future. Operators trying to pursue such strategies will be unable to raise the necessary capital to fund further network improvements.

Allowing prices to adjust will ensure spectrum becomes available for its most efficient use but will not unduly increase the cost burden. Evidence shows that excessive spectrum cost defeats the incentives for further network

investment, leading to lower network quality and slower deployment. Conversely, an easing of spectrum cost in Bangladesh will improve the incentives to invest in deployment of new spectrum bands and technologies, leading to improved consumer outcomes and capitalising on the economic growth opportunity offered by technologies supported by mobile.

A reduction of spectrum cost could stimulate 4G improvements and accelerate 5G rollout

Our economic modelling shows that an easing of spectrum cost could bring substantial economic benefits:

- **Under a scenario of past prices and high cost of spectrum**, 4G networks would only have moderate improvements, while the rollout of 5G would be postponed and deployment would be scaled down, reaching 86% of the population by 2035.
- **Under a scenario of reduced unit prices that aligns total spectrum cost closer to the Asia Pacific median**, 4G speeds could be boosted by 17%, while the rollout of 5G could be brought forward and scaled up to reach 99% of the population by 2035. The improvements in connectivity would generate $34 billion in economic benefits by 2035.
- **Under a scenario of alignment of the aggregate cost of spectrum with the global median**, 4G speeds could be boosted by 22%, while the rollout of 5G could be accelerated even further. The improvements in connectivity would generate $45 billion in economic benefits by 2035.

These results show that the impacts of spectrum pricing stretch beyond the direct effect on finances of the mobile sector. Regulators seeking to maximise the social value of spectrum in Bangladesh should take into account these wider economic benefits when setting out the approach to pricing during renewals and new spectrum assignments. Ultimately, the role of spectrum pricing is to ensure it is assigned to the use that generates the greatest benefits to society.

High spectrum prices can result in unsold spectrum, leading to lower government receipts and unused spectrum

Direct revenue from spectrum fees increases in proportion to unit prices. However, the possibility of unsold or returned spectrum means that the realised revenue could diminish for higher price levels. Returned or partly unsold spectrum are a likely outcome if prices are set based on past values or outdated benchmarks, as scenario modelling shows that sale of all spectrum at these prices would take the aggregate spectrum cost to levels that cannot be justified by commercial fundamentals.

Lower spectrum costs can boost economic activity and increase public-sector tax revenues, despite initially lower direct spectrum fee receipts

As shown in our modelling, lower pricing can result in billions of dollars of economic growth, translating into higher tax revenues across the economy. Hence, while high spectrum fees can in the short term generate additional revenue for the government, in the long term they can be detrimental to economic growth and worsen public finances. This comparison does not consider the overarching net benefits to wider society, as the economic impacts measured in terms of GDP should not be compared to government revenue impacts.

Because of these wider benefits, pricing of spectrum should optimally be used to ensure efficient assignment rather than to maximise government revenues, as public finances can be more efficiently boosted using other, more economically efficient forms of taxation.

The approach to licence renewal and spectrum assignment should account for long-term economic benefits

The objective of regulators and governments is to maximise the social value of spectrum, which needs to consider the transformative effect of mobile connectivity on the broader economy. Hence, the approach to licence renewal and assignment of spectrum in Bangladesh should be guided by the considerations outlined in Figure 17.

Figure 17

Considerations for spectrum licence renewal and new spectrum assignment in Bangladesh

Spectrum licence renewal	New spectrum assignments
When relying on administrative processes for licence renewals, prices should not be linked to historical prices paid for a given assignment	When relying on auctions to assign new spectrum, regulators should not anchor reserve prices to historical prices – either those observed in Bangladesh in the past or in other markets
• Renewal pricing should be structured to reflect the economic value of spectrum in Bangladesh, enabling operators to invest in network expansion while easing the regulatory cost burden. • Using renewal fees to maximise government revenue will result in excess burden on operators and scaled down or delayed improvements to mobile networks. Conversely, easing the burden of spectrum cost can improve the viability of further investment, resulting in upscaled and accelerated deployment and enhanced consumer welfare. • Lower pricing reduces the risk of returned spectrum during renewals. Returned spectrum comes with a significant opportunity cost: less spectrum for mobile networks leads to worse consumer outcomes. • Renewal allows an opportunity to update licence terms, which can be used to provide additional flexibility and maximise the value of spectrum. This can include denomination in local currency to eliminate the exchange rate risk, maximising licence durations to provide certainty of access and providing flexible instalment options given the long-term period of return on spectrum. • Spectrum is an intermediate input to deliver mobile services, yet in Bangladesh spectrum fees incur additional value-added tax (VAT), currently at 7.5%. From the perspective of public finances, there is equivalence between spectrum fees and VAT, as both directly raise revenue. However, exempting spectrum fees from VAT will prevent future changes to VAT unpredictably affecting the cost of scheduled instalments. This will help investment planning.	• Reserve prices should be set to discourage frivolous and tactical bidding, but not serve as a tool to maximise revenue. In practical terms, reserve prices should be set at a level that reduces the risk of unsold spectrum to negligible levels, avoiding the risk of idle bands and delayed network expansion. • Reserve prices should be set in reference to the estimated fundamental value of spectrum. These fundamentals clearly show that the value of each MHz from the perspective of an operator has declined globally and in Bangladesh. Historical prices realised in previous assignments do not reflect the current reality of Bangladesh's mobile market. • When relying on benchmarks, we recommend relying only on recent assignments that can give a large enough sample or using a price normalisation method that reflects the changing fundamentals of the value of spectrum. For example, this could mean adjusting historical benchmark prices in proportion to the change in the revenue per MHz per connection since the assignment. • Licence terms should be supportive of long-term investment, such as extending licence durations to provide the necessary certainty, allowing flexible instalment plans or enabling the exchange of spectrum fees for commitment to coverage and quality obligations.

Source: GSMA Intelligence

In Bangladesh, the approach to pricing should minimise the risk of unsold spectrum

There is much uncertainty about the true value of spectrum given the existing high burden of regulatory costs. This calls for an approach that minimises the risk of unsold spectrum. Relying on multiple approaches to valuation can help judge the level of uncertainty in the estimates. For reserve prices, we recommend applying at least a 50% discount to the lowest estimated value from the range. This adjustment allows room for price discovery and provides a necessary margin to minimise the risk of unsold spectrum, given the uncertainty in estimates.

For renewals based on direct price setting, we recommend relying on pricing based on the opportunity cost of alternative spectrum use. Where it is determined that existing users remain the most efficient users of spectrum, a free-of-charge extension of licences with a commitment to continued service may prove to be a cost-effective approach to licence renewal.

Case study

Australia's proposed approach to renewal pricing reflects the changing economic fundamentals

A number of spectrum licences in Australia are set to expire in the next few years, prompting the Australian Communications and Media Authority (ACMA) to rely on a sophisticated price analysis methodology. To account for the changing economic fundamentals of the value of spectrum, historical unit price benchmarks ($/MHz/population) are adjusted by the mobile service revenue (MSR)/MHz/population index.

The index is critical for capturing the dynamic nature of spectrum value. Unlike traditional inflation metrics such as the consumer price index, which may not reflect telecommunications-specific trends, the MSR/MHz/population index accounts for the following:

- **Increased spectrum supply:** Today, operators need much more spectrum to support each connection. This has diluted the market value of each MHz of spectrum.
- **Declining or stagnant revenue:** In most markets, competition has brought lower revenues per connection, further reducing the addressable mobile market each MHz can support.
- **Population growth:** By normalising for population, the index ensures prices reflect the value of spectrum in per capita terms, so that it can be applied to adjust the historical benchmark values typically calculated in $/MHz/year/population.

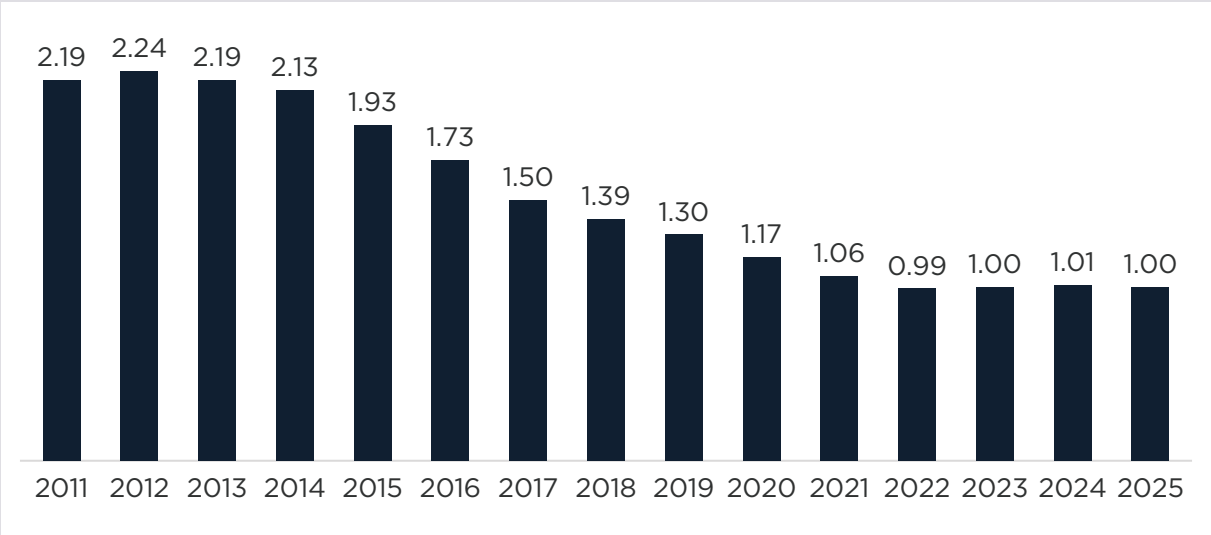
Using the index, a spectrum price benchmark from a 2010 auction would be scaled down when carried forward to 2024–2025, reflecting the index's observed decline from a higher historical value to a lower current value. For future renewals, the index ensures that historical benchmarks are appropriately adjusted to serve as a guide for the current value of spectrum.

ACMA's proposed approach is an example of a robust and market-driven methodology that leverages the MSR/MHz/population index to reflect the changing value of spectrum. By adjusting historical valuations to account for declining spectrum value and projecting future prices, ACMA ensures renewal costs are fair and aligned with economic realities.

Figure 18

Market revenue per MHz per unit of population has rapidly declined in Australia

Three-year moving average index (2025 = 1.00)



Source: ACMA[7]

[7] Expiring spectrum licences (stage 3) – Preliminary views paper 4: Pricing for ESLs, ACMA

Appendix: methodology

Benchmarking analysis

GSMA Intelligence performed benchmarking analysis of unit spectrum prices over time based on a licence-level dataset of individual spectrum licences. For each licence, the dataset includes information on the frequency band, bandwidth (MHz), licence start and end date, duration and applicable geographic area (typically a country, but also a region for licences in some countries). From the data, we calculate unit prices for different band and year combinations using benchmark formulas.

We relied on two different definitions of unit prices:

- **Spectrum cost per unit of population ($2023 PPP/MHz/year/population, adjusted for weighted cost of capital).** In the case of regional (sub-national) licences, the benchmark is based on the population covered by the licence.
- **Spectrum cost per unit of revenue ($/MHz/year/$ million of mobile market recurring revenue at the time of assignment, adjusted for weighted cost of capital).** In the case of regional licences, the market revenue is weighted by the population covered by the licence as a percentage of the total population.

Data sources are shown in Table A1. Licence-level data used in presented spectrum price trends covers assignments from 2012 or later, though the presented benchmarks (last five years) rely on assignments since 2020.

Adjustment for the weighted average cost of capital (WACC) reflects the time value of money when operators are required to pay upfront for a licence with a given duration. The WACC adjustment amortises the cost of a licence over its duration, taking into account the cost of capital required to make an upfront payment (or a given schedule of instalments).

Table A1

Data sources used in the benchmarking of spectrum prices

Licence-level data	Source
Individual licence start and end dates, bandwidth, frequency band, prices	Constructed from licence-level data obtained from Bangladesh's operators and from the GSMA Intelligence Spectrum Navigator database (January 2025)
Market data	**Source**
Mobile market recurring revenue	GSMA Intelligence, 2024
Population	IMF World Economic Outlook, 2024
Currency exchange rates	IMF World Economic Outlook, 2024
Weighted average cost of capital	GSMA Intelligence estimates based on equity risk premium data by Damodaran (2024), average gearing ratio estimates for the telecoms sector by Damodaran (2024) and the risk-free rate proxy based on the US 3-Month Treasury Bill Secondary Market Rate data from the Federal Reserve Bank of St. Louis.

Source: GSMA Intelligence

The WACC-adjusted annualised payment is calculated using a formula converting the present value of a lump-sum payment into an equivalent annuity with payments over the duration of the licence. Since most licences in Bangladesh allowed for payment in instalments, annualisation is achieved in two steps. First, we convert the value of payments into present value by applying discount factor to scheduled payments. If the instalment was paid in US dollar, a conversion to Bangladeshi taka was applied to the payment using the exchange rate prevailing at the time of instalment. In the next step we apply the annuity formula converting the present value into equal annual payments over the duration of a licence.

Equation 1: Adjustment of upfront cost based on the cost of capital

$$\text{WACC-adjusted annualised licence cost} = \frac{\text{Upfront cost}}{\dfrac{1-\left(\dfrac{1}{1+\text{WACC rate}}\right)^{\text{Duration in years}}}{\text{WACC rate}}}$$

Calculations for the cost of spectrum

Spectrum cost calculations are based on licence-level data provided by the three largest operators in Bangladesh: Robi, Grameenphone and Banglalink. We could not include the remaining national operator in Bangladesh (Teletalk), but due to its small market share this is unlikely to affect the results.

Table A2

Sources of data and assumptions used in calculating international spectrum price trends and benchmarks

Variable	Source
Amount of IMT spectrum assigned to public mobile networks	Constructed from licence-level data supplied by the operators.
Upfront and annual or incidental spectrum fees	Derived from licence-level data provided by mobile operators. Incidental spectrum fees include licence conversion fees and merger-associated fees. Future annual fees are assumed to increase at the same rate as upfront licence fees.
Mobile sector historical revenue	Historical revenue figures based on data supplied by mobile operators.
Weighted average cost of capital	GSMA Intelligence estimates based on equity risk premium data by Damodaran (2024), average gearing ratio estimates for the telecoms sector by Damodaran (2024) and the risk-free rate proxy based on the US 3-Month Treasury Bill Secondary Market Rate data from the Federal Reserve Bank of St. Louis.

Source: GSMA Intelligence

Annual spectrum fees data has been obtained from the operators. Projection of annual spectrum fees is based on a simplifying assumption that they will follow the same growth rate as the aggregate upfront cost of all licences.

We rely on the spectrum-cost-to-revenue ratio as a measure of the total cost of spectrum from all active licences owned by the three largest operators in Bangladesh. Hence, the ratio is estimated as shown in Equation 2.

Equation 2: Spectrum-cost-to-recurring-revenue ratio formula

$$\text{Spectrum-cost-to-recurring-revenue ratio} = \frac{\text{WACC-adjusted annual upfront cost of all active licences + Annual spectrum fees}}{\text{Annual recurring revenue}}$$

The WACC-adjusted annualised spectrum cost for each active licence is calculated as outlined earlier in the section on benchmarking analysis. The cost of licences that started or expired during a particular year is attributed in proportion to the number of days the licence remained active in a given year. For example, if a licence ended on the 100th day of the year, only 100/365 of the annualised cost of the licence was attributed to that year.

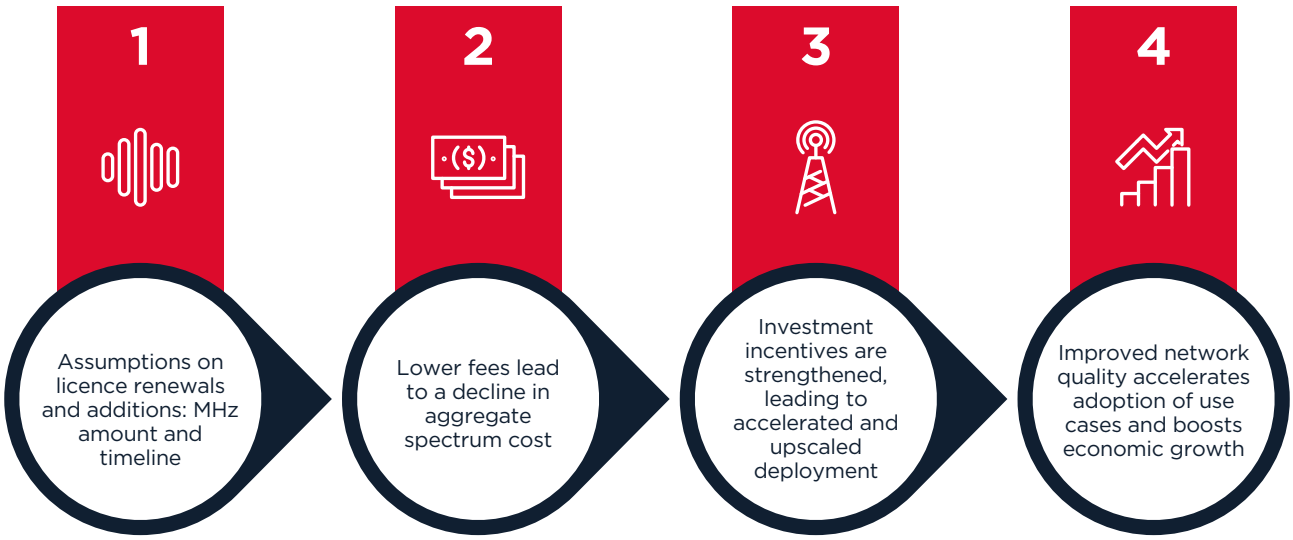
Annual recurring revenue data has been sourced from the GSMA Intelligence database. Recurring revenue is defined as revenue from mobile subscriptions, excluding other streams such as sales of devices.

Economic impact: modelling approach

To model the economic impact of different spectrum pricing scenarios, we link the available evidence in four steps (Figure A1).

Figure A1

Approach to economic impact modelling



Source: GSMA Intelligence

The model is a parameterised calculator tool incorporating inputs on spectrum cost and baseline economic projections. The baseline projections regarding key economic and mobile-sector projections are obtained from various sources. We then use parameterised equations to estimate impacts, initially to calculate how a difference in spectrum cost will impact 5G rollout and 4G improvements, and in turn how changes to these will impact economic growth. We rely on the following key pieces of evidence.

To measure the impact of spectrum cost on 5G rollout:

- We parameterise the relationship between spectrum cost and network coverage based on evidence from previous analyses establishing the cause-and-effect relationship between spectrum cost and rollout of previous generations (3G and 4G). This evidence shows that a 1 percentage point lower spectrum cost leads to 2 percentage points higher network coverage. This relationship can reasonably be expected to also hold during the rollout of 5G.
- In the next step, as a result of increased 5G network coverage, we calculate how the expansion of the 5G network allows additional populations living in 5G-covered areas to upgrade from earlier generations to 5G and increases the overall 5G penetration. We do this by multiplying 5G adoption by the change in 5G coverage. 5G adoption is defined as the population using 5G as a share of population living in 5G-covered areas. For example, if as a result of lower spectrum cost 5G coverage is estimated to increase by 4 percentage points and 5G adoption in that year is assumed to be 75%, this implies that the 5G penetration will increase by 4*75% (3 percentage points).
- In the last step, we use the established evidence on the economic impact of generational mobile network upgrades. Because the magnitude of impact of 5G has not yet been established in empirical literature, we assume that this impact will be the same as generational upgrades from earlier technologies (e.g. 3G to 4G). We rely on a parameter of a 1 percentage point increase in 5G penetration resulting in a 0.015% GDP uplift, based on GSMA Intelligence (2020).

To measure the impact of spectrum cost on 4G network speeds and economic growth:

- We parameterise the relationship between spectrum cost and network speeds based on existing evidence. This evidence shows that 1% lower spectrum-cost-to-revenue ratio results in a 0.6% increase in 4G network download speeds.

- In the next step, we calculate how the increase in 4G network speeds contributes to overall network speeds. To do this, we apply simplified weighting based on the share of 4G of the total number of connections. For example, if 4G accounts for 50% of active mobile connections and we estimated that 4G speeds will increase by 4% as a result of lower spectrum cost, this is proxied to improve the overall network speeds by 2%.

- In the last step, we estimate the impact of improved mobile speeds. This is parameterised based on earlier studies showing that a doubling of broadband speeds can contribute 0.3% to GDP growth, based on Rohman and Bohlin (2012).

To avoid double counting of impacts on 4G and 5G networks, we assume that half of the difference in spectrum cost will channel through to 4G network improvements, and the other half will channel through to affect 5G network rollout.

Economic impact: data sources and parameters

To calculate economic impacts and various intermediate inputs, we rely on a number of assumptions and baseline forecasts. The sources of these are summarised in Table A3.

Economic impact: scenario definitions

We assume the following renewal schedule and new spectrum assignment roadmap, which is aligned with the latest BTRC roadmap.

To illustrate how different approaches to pricing spectrum will impact its aggregate cost and to apply economic modelling, we rely on three illustrative pricing scenarios.

All three scenarios assume that all planned spectrum assignments and renewals will result in assignment of all available spectrum, leaving no unsold lots. However, it is also plausible that high prices could result in unsold or returned spectrum. While it is not possible to reasonably judge at what price level this could occur, we do not examine scenarios under which spectrum remains unsold. However, evidence shows that lower spectrum availability leads to negative impacts on both coverage and network speeds, so the impacts of lower pricing and avoiding unsold spectrum could be similar to those assessed.

To form baseline assumptions on unit prices (scenario 1) in the upcoming assignments of new spectrum and renewals, we rely on a combination of historical benchmarks for previous assignments in Bangladesh for bands already assigned and a combination of historical national and international benchmarks for new bands. A detailed description of assumptions is provided in Table A6. Price assumptions for scenarios 2 and 3 are based on these unit prices discounted by 50% and 75%, respectively.

Additionally, we assume that the payment schedule will allow for payment in 10 equal interest-free, BDT-denominated instalments, with the first instalment paid at the start of the licence. This assumption is used in converting the unit prices to amortised payments over the licence duration, incorporating further assumptions on the WACC faced by the operators.

For scenarios 2 and 3, we appropriately reduce these unit prices by 50% and 75%, respectively. All figures quoted in Table A6 exclude VAT. However, for the purpose of the calculation of total cost and the spectrum-cost-to-revenue ratio we assume operators will be additionally charged VAT at a constant 7.5% rate regardless of band or scenario.

These assumptions, combined with the revenue forecast, allow us to estimate how the spectrum-cost-to-revenue ratio will evolve over time and to model the economic impacts, as outlined in the preceding section on economic modelling.

Table A3

Sources of data and assumptions used in economic impact modelling

Variable	Source
Population, exchange rates, baseline GDP forecast	IMF World Economic Outlook (April 2024 release)
Reference 5G population coverage forecast	The beginning of a full-scale 5G rollout (2028) is aligned with the most likely outcome under scenario 2 based on consultations with the operators and the planned 2027 release of the key 3.5 GHz band. Population coverage values in years since the beginning of the rollout are based on Bass diffusion curve parameters estimated using the historical 4G rollout curve. While smaller-scale 5G trials and limited deployments have already taken place in limited areas of Bangladesh using the existing spectrum, in our modelling of economic benefits we calculate these based on the availability and adoption of 5G powered by all key bands. This is preferred because only when using the capacity in all key bands (700 MHz and 3.5 GHz) does the technology offer a full incremental quality improvement that leads to realisation of economic benefits.
Baseline 4G network average download speeds	Based on connection-weighted peak hour average 4G network download speeds reported by operators (December 2024). Baseline projection assumes that by 2030, the average 4G network download speeds grow to match the 2023 average 4G network download speeds in a sample of countries where 4G network deployment has been finalised (Germany, Japan, South Korea, Singapore). Sourced from Ookla Speedtest.
Projected revenue of the mobile sector	GSMA Intelligence forecast, between 2025 and 2035, with a compound average growth rate of 7.3% in nominal terms. We rely on a simplifying assumption that revenues do not vary across scenarios.
Baseline 5G adoption forecast	5G adoption is defined as the number of 5G connections divided by the population covered by 5G networks. Baseline scenario assumes the same as the historical adoption rates of 4G since the initial rollout year of 4G coverage in Bangladesh.
Weighted average cost of capital	GSMA Intelligence estimates based on equity risk premium data by Damodaran (2024), average gearing ratio estimates for the telecoms sector by Damodaran (2024) and the risk-free rate proxy based on the US 3-Month Treasury Bill Secondary Market Rate data from the Federal Reserve Bank of St. Louis. Future 2024–2035 values based on extrapolation of the last available estimated value (2023).
Economic impact parameter of generational improvement in mobile technology	GSMA Intelligence (2020) (full incremental technological upgrade of mobile resulting in 1.5% GDP uplift)
Economic impact parameter of improving network speeds	Rohman and Bohlin (2012) (doubling of broadband speeds can contribute 0.3% to GDP growth)

Source: GSMA Intelligence

Table A4

Renewal schedule and new spectrum assignment roadmap

Renewal schedule (MHz)	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
800											
900		2 x 19.8				2 x 1.6				2 x 5.4	
1800		2 x 39.6				2 x 10			2 x 10.6	2 x 10	
2100		2 x 20		2 x 35					2 x 5		
2300									70		
2600									160		
New spectrum release (MHz)	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
700	2 x 45										
800		2 x 10									
900		2 x 3.4									
2300		20									
3500			460								
600							2 x 35				
1400								91			
6000											700

Source: GSMA Intelligence assumptions based on BTRC's spectrum roadmap

Table A5

Outline of scenario assumptions

Scenario	Description
Scenario 1: current and past prices (reference scenario)	Operators pay prices aligned with average past unit prices (per MHz/year/population (inflation-adjusted)), extrapolated across new bands using relative band price ratios based on international benchmarks.
Scenario 2: adjustment closer to the Asia Pacific median cost	Prices in upcoming assignments and renewals decrease by 50%, preventing further build-up in spectrum cost. Spectrum cost gradually declines closer to the Asia Pacific median cost.
Scenario 3: aligned with the global median cost	Unit prices decrease by 75%, which aligns the spectrum-cost-to-revenue ratio to about 8%, similar to the global median.

Source: GSMA Intelligence

Table A6

Scenario 1 reference assumptions: historical and past prices

Band	Configuration	Unit	Current and historical Bangladesh benchmarks (2024 BDT/MHz/year/ population, WACC-adjusted)	Assumptions and sources
600 MHz	FDD	2 x 1 MHz	1.15	Assumed the same as 900 MHz band
700 MHz	FDD	2 x 1 MHz	1.15	Assumed the same as 900 MHz band
800 MHz	FDD	2 x 1 MHz	1.15	Assumed the same as 900 MHz band
900 MHz	FDD	2 x 1 MHz	1.15	Based on recent prices offered by the BTRC (BDT 2.628 billion for 2 x 1 MHz)
1400 MHz	TDD	1 MHz	0.26	Based on average historical Bangladesh benchmark for 1800 MHz multiplied by the ratio of international benchmarks of value of 1400 MHz relative to the 1800 MHz band
1800 MHz	FDD	2 x 1 MHz	1.15	Based on recent prices offered by the BTRC (BDT 2.628 billion for 2 x 1 MHz)
2.1 GHz	FDD	2 x 1 MHz	1.07	Based on recent prices offered by the BTRC (BDT 2.459 billion for 2 x 1 MHz)
2.3 GHz	TDD	1 MHz	0.38	Based on average historical Bangladesh benchmark from previous assignments
2.6 GHz	TDD	1 MHz	0.35	Based on average historical Bangladesh benchmark from previous assignments
3.5 GHz	TDD	1 MHz	0.30	Based on average historical Bangladesh benchmark for 2.6 GHz multiplied by the ratio of international benchmarks of value of 3.5 GHz relative to the 2.6 GHz band
6 GHz	TDD	1 MHz	0.15	Assumed as the average of the 3.5 and 26 GHz bands
26 GHz	TDD	1 MHz	0.01	Assumed unit prices of 3.5 GHz multiplied by the ratio of international benchmarks of 26 GHz relative to the 3.5 GHz band

Source: GSMA Intelligence assumptions based on the GSMA Intelligence Spectrum Navigator database and data supplied by operators in Bangladesh and other sources

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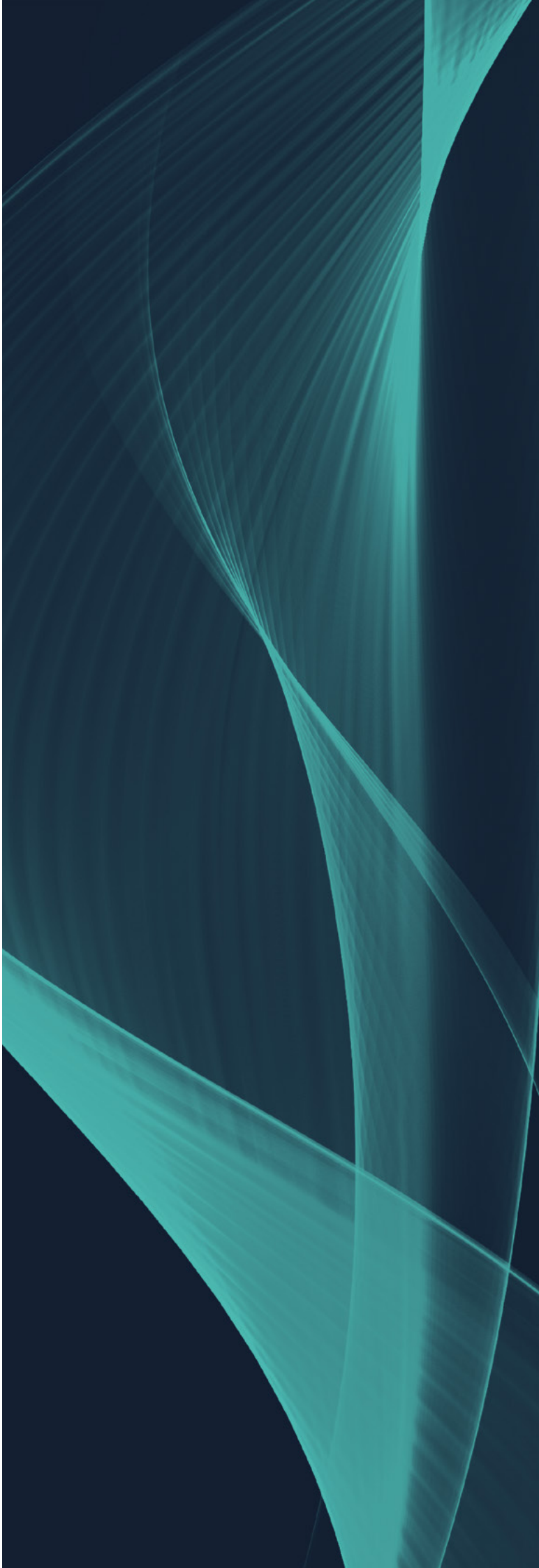

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